

the same amount of haze when the air is very dry than when it is dampish. It will also be noticed that the transparency of the air is roughly proportional to the wet bulb depression. It should be noted that it is not the amount of vapour in the air that produces this effect, but the nearness of the vapour to the dew point which seems to enable the dust particles to condense more vapour by surface attraction and otherwise, and thus, by becoming larger, they have a greater hazing effect. The above table shows the relation between the humidity, the dust, and the transparency, so that knowing any two of them we can calculate the third.

The paper then proceeds to an examination of the relation between the dust and the haze from the Ben Nevis reports for the periods of the Kingairloch observations, when it is seen that on all days when the air was very clear the number of particles was small at high and low levels, and the transparency was least when the amount of dust was greatest. On one occasion Ireland, which is 125 miles distant, was seen from Ben Nevis, and only a thin haze was visible. On that day the number was about 200 per cc. at low level, and under 200 at high level, and, as the numbers remained very constant at both levels all day, this day may be looked upon as one of the purest as well as one of the clearest observed.

The next set of observations discussed are those made at Alford, in Aberdeenshire. The air at that station was always very pure, except when the wind was southerly, and brought impure air from the inhabited districts. The values of C for the different humidities were calculated from the Alford observations, and the results will be found in the following table. When at Alford some observations were made on Callievar, a hill about 1747 feet high. The values of C from three observations made on Callievar do not agree with the others, being only about one-half as great.

The difference in the value of C obtained from the Callievar observations opened up the question of the value of C as obtained from observations at low level. The difference in the two values might be due to the tests at low level being made in locally impure air, near the surface of the earth, while the estimates of haze are made partly through purer upper air, and in calculating the value of C it is assumed that the air all through the length in which the haze is estimated has the same amount of dust as at low level, whereas it may have less. If, then, the low level observations be made in polluted areas, they will give too high a value for C. The difference between the amount of dust at Kingairloch and Ben Nevis does not, however, account for anything like the difference given by the Callievar observations. As there were only three observations made on Callievar, it was thought as well to test this point by working out the values of C from the Rigi observations. When this was done they were found to be similar to those for the Kingairloch observations. The following table shows the different values of C at the different wet bulb depressions, calculated from the different sets of observations:—

Place.	Wet bulb depression.		
	2° to 4°	4° to 7°	7° to 10°
Kingairloch, 1893 .	77,000	106,000	141,000
„ 1892 .	No observations	117,000	175,000
Alford . . .	75,000	95,000	125,000
Rigi Kulm . . .	75,000	104,000	124,000
Mean . . .	76,000	106,000	141,000

What are called purifying areas in this paper are those regions on the earth's surface in which the air loses more impurity than it gains. In all densely-inhabited areas it loses its purity, and in all uninhabited ones it tends to regain it; but all uninhabited areas are not equally good purifying ones. Much of the dusty impurity discharged into our atmosphere from artificial sources, by volcanoes, and by the disintegration of meteoric matter, falls to the ground, but much of it is so fine it will hardly settle. The deposition of vapour on these very small particles seems to be the method adopted by nature for cleansing them away; they become centres of cloud particles, and ultimately fall with the rain. It may be remarked that all very low numbers

at Kingairloch were obtained in close misty rain, and in the clouds near the earth, in the very area in which the dust was being used up. This experience is confirmed by the observations made on Ben Nevis. From this it might be expected that the areas where most clouds form, and most rain falls, will have the greatest purifying influence. This conclusion is confirmed by the dust observations made in air coming from four great purifying areas, namely, the Mediterranean, the Alps, the Highlands of Scotland, and the Atlantic. The following figures show the mean values of the lowest readings observed in each of the five years in air coming from these areas; the Mediterranean, 891 per c.c.; the Alps, 381; the Highlands, 141; and the Atlantic, 72. It should be noted that these are not the mean numbers, but the mean of the lowest, and represent the maximum purifying power of the different areas.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE sixth summer meeting of University Extension and other students will be held in Oxford from July 27 to August 24. Courses of study are provided in numerous subjects of interest and importance. Among the science courses are included lectures on physical problems relating to astronomy, by Dr. A. H. Fison. Mr. Henry Balfour, Curator of the Pitt-Rivers Museum, will lecture upon the arts of mankind and their evolution, illustrating his discourses by specimens exhibited in the museum. Geology, both lectures and field work, has been undertaken by Prof. A. H. Green, F.R.S. Dr. C. H. Wade will conduct lectures and classes in hygiene, and Mr. J. E. Marsh have charge of students in courses of practical chemistry at the chemical laboratory in the University Museum. A lecture on colour vision will also be given by Captain W. Abney. In addition to these courses, and many others on history, literature, economics, and art, there will be a course on the science and art of education, comprising lectures on psychology, the theory of education, and the educational systems of England, France, and Germany. Instruction in wood-carving, Sloyd, and photography can also be obtained at the meeting.

THE *Oxford University Extension Gazette* announces that the council of the London Society for the Extension of University Teaching has decided to hold in London, on June 22 and 23, a conference representative of all the authorities concerned in the work of University Extension. The purpose of the conference will be to sum up and present the educational results of University Extension work since the inauguration of the movement, and to discuss practical proposals and a general policy for the future in the light of past experience. Official representatives of the Universities of Oxford, Cambridge, and London will be asked to preside over the three sessions of the conference, which by emphasising the unity of the University Extension system, will doubtless increase public interest in this branch of educational work.

SCIENTIFIC SERIALS.

Bulletin de l'Académie Royale de Belgique, No. 1.—Another word on the definition of latitude, by F. Folie. If a displacement of the pole of inertia really exists, the difference between the astronomical latitudes of two places situated upon opposite meridians, such as Berlin and Honolulu, will be positive in summer and negative in winter. It is therefore best to take as a point of reference, not the instantaneous pole, but the mean position of the pole of inertia, *i.e.* the geographical pole. As regards the direction of displacement of the pole of inertia, M. Folie's latest conclusion is that it is retrograde, with a period of 321 instead of 423 days.—Explanation of the systematic differences between the catalogues of Greenwich, Melbourne, and the Cape, by diurnal nutation and the annual displacement of the pole of inertia, by the same author. The hitherto unexplained systematic differences between the three catalogues are eliminated by the introduction of the constant term entering into the expression for diurnal nutation.—A new gradual synthesis of benzene, by Maurice Delacre. This synthesis starts, like the one previously described, with acetophenone, and passes through dypnone and dypnopinacone to the γ varieties (not the α series) of dypnopinacolone, dypnopinalcohol, and dypnopinalcolene to triphenylbenzene.—Application of the refractometer

to the study of chemical reactions, by J. Verschaell. The Pulfrich refractometer used, when compared with a standard spectrometer, gave a constant difference in the index of refraction amounting to -0.00069 , this being probably due to the insertion of a prism of different material in the refractometer. With this correction the refractometer readings could be taken as absolutely trustworthy to the fourth decimal place. The author shows that all disagreements with the law governing the index of refraction of mixtures indicate a chemical reaction (1) if the observed index is lower than the calculated index; or (2) if it is higher by such an amount that the difference cannot be attributed to a change of volume.—On the parietal eye, the epiphysis, the paraphysis, and the choroid plexus of the third ventricle, by P. Francotti. This paper contains a detailed description, illustrated by excellent microphotographs, of these rudimentary organs as they appear in the slow-worm and the human embryo.

Wiedemann's *Annalen der Physik und Chemie*, No. 3.—On elliptic polarisation of reflected light, by K. E. F. Schmidt. This first part of the work deals with the influence of foreign surface layers. Contrary to the conclusions of Drude, Röntgen, and Lord Rayleigh, the author shows that no observation justifies us in assuming that the elliptic polarisation of light reflected from polished surfaces is produced by layers of the polishing material. The polish attached to the mirror is only capable of modifying the phenomenon. The constancy of the ellipticity of light reflected from mirrors cleaned by means of a gelatine film, which is pulled off when hardened, implies a constancy of the cause of this phenomenon, independent of the polishing powder used.—Remarks upon Paschen's paper on "The emission of heated gases," by E. Pringsheim. The author maintains that the so-called discontinuous heat spectra observed by Paschen, cannot be fitly described as such, since the "band" due to CO_2 extends over a region three times as large, and that of steam over one twenty times as large, as the whole visible spectrum.—On normal and anomalous changes of phase during the reflection of light by metals, by W. Wernicke. The change of phase produced by the reflection of light from a silver film between two transparent media, the anterior one of which has the higher index of refraction, is an acceleration which increases continuously from zero to $\frac{1}{4}$ or $\frac{3}{8}$ of a wave-length as the thickness of the silver grows from zero to opacity. This is the normal change of phase. An anomalous retardation takes place when there are traces of another substance between the silver and the front medium. It may amount to something between $\frac{1}{8}$ and $\frac{3}{8}$ of a wave-length.—On the proportionality between lowering of freezing point and osmotic pressure, by Svante Arrhenius.—On a more exact method for the determination of the lowering of freezing points, by E. H. Loomis. The apparatus used was an improved form of Beckmann's freezing tube. To avoid the fluctuations of temperature associated with the melting or solidifying of ice in water, sometimes amounting to 0.1°C ., the tube was lengthened so as to remove the substance from the warmer air, and a freezing mixture was in each case employed, which gave a temperature only about 0.3° lower than the actual freezing point of the substance experimented upon.

In the numbers of the *Journal of Botany* for March and April, the articles are almost entirely descriptive. Mr. E. G. Baker has an interesting paper on the section *Rhynchospetalum* of *Lobelia*, in which two new species from Africa are described and figured.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Meteorological Society, March 21.—Mr. R. Inwards, President, in the chair.—Mr. W. H. Dines read a paper on the relation between the mean quarterly temperature and the death-rate. The Registrar-General's Quarterly Returns for the whole of England since 1862 were taken by the author, and the number of deaths in each quarter expressed as a departure per thousand from that particular quarter's average; the value so obtained being placed side by side with the corresponding departure of the temperature at Greenwich from its mean value. The rule seems to be that a cold winter is unhealthy, and a mild winter healthy; and that a hot summer is always unhealthy, and a cold summer healthy. Mr. Dines also

read a paper on the duration and lateral extent of gusts of wind and the measurement of their intensity. From observations and experiments which he has made with his new anemometer, Mr. Dines is inclined to think that a gust seldom maintains its full force for more than one or two seconds; and also that the extreme velocity mostly occurs in lines which are roughly parallel to the direction of the wind.—Mr. R. H. Scott, F.R.S., exhibited a diagram showing some remarkable sudden changes of the barometer in the Hebrides on February 23, 1894. At 8 a.m. the reading at Stornoway was 29.39 inches, being a fall of 0.7 inch since the previous day, and at 6 p.m. the reading was 28.58 inches. From the trace of the self-recording aneroid it appears that the minimum, 28.50 inches, occurred about 5.30 p.m., and that the fall during the half-hour preceding the minimum was nearly 0.2 inch, the rise after the minimum being nearly as rapid.—The other paper read was on the calculation of photographic cloud measurements, by Dr. K. G. Olsson.

Geological Society, March 21.—Dr. Henry Woodward, F.R.S., President, in the chair.—The following communications were read:—On the origin of certain novaculites and quartzites, by Frank Rutley. The novaculites of Arkansas have already been admirably described by Mr. Griswold in vol. iii. of the Arkansas Survey Report for 1890. One of the characteristic microscopic features in Ouachita stone is there stated to consist in the presence of numerous cavities, often of sharply-defined rhombohedral form, which Mr. Griswold considers to have been originally occupied by crystals of calcite or dolomite. The author, while admitting that the cavities were no doubt once filled by the latter mineral, differs from Mr. Griswold, and some of the authorities he cites, concerning the origin of the rock. Crystalline dolomites, when dissolving, become disintegrated into minute but well-formed rhombohedra. As the process of dissolution proceeds these crystals may become so eroded that the rhombohedral form is no longer to be recognised. The author pointed out that no inconsiderable proportion of the cavities in Ouachita stone present irregular boundaries, such as the moulds of partially eroded rhombohedra would show. He then offered a fresh interpretation of these cavities, so far as the origin of the rock was concerned: (1) He assumed that beds of crystalline magnesian limestone have been slowly dissolved by ordinary atmospheric agency and the percolation of water charged with carbonic acid or other solvent. (2) That, as the limestone was being dissolved, it was at the same time being replaced by silica, which enveloped minute isolated crystals and groups of crystals, some perfect, others in various stages of erosion. (3) That the silica assumed the condition of chalcedony, its specific gravity, as stated by Mr. Griswold and as determined by the author, being low in comparison with that of quartz. (4) The residuum of the original dolomite or dolomitic limestone was removed, leaving the perfect and imperfect rhombohedral cavities. A calciferous, gold-bearing quartzite from the Zululand gold-fields was described, and a similar origin ascribed to it, but in this case the original rock appears to have been simply a limestone, not a dolomite. The gold seemed to occur chiefly in the calcareous portions of the rock. The author also suggested a similar origin for the saddle-reefs of the Bendigo gold-field. In all of these cases the train of reasoning is based upon the conclusions arrived at in his previous paper, "On the dwindling and disappearance of limestones." He indicated that the stratigraphical relations of the Arkansas novaculites, as described in Mr. Griswold's report, were such as to warrant the assumption that limestones once occurred in the position now occupied by beds of novaculite. Many collateral matters were dealt with in the paper which cannot be given in abstract; among them was an attempt to classify quartzites. Dr. G. J. Hinde and Prof. Hull discussed some of the conclusions in the paper, and the author briefly replied.—Note on the occurrence of perlitic cracks in quartz, by W. W. Watts. The author of this communication described some specimens of the porphyritic pitchstone of Sandy Braes in Antrim, which are deposited in the Museum of Science and Art in Dublin, and in that of Practical Geology in Jermyn Street. They exhibit admirable examples of perlitic structure in the brown glassy matrix, and the presence of polygonal, circumferential, and radial cracks is noticed. The porphyritic crystals of quartz are traversed by curved fissures of retreat, not so perfect as those found in the glass, but better than those usually produced by the rapid cooling of Canada balsam. The fissures in the quartz are frequently prolonged into the matrix,